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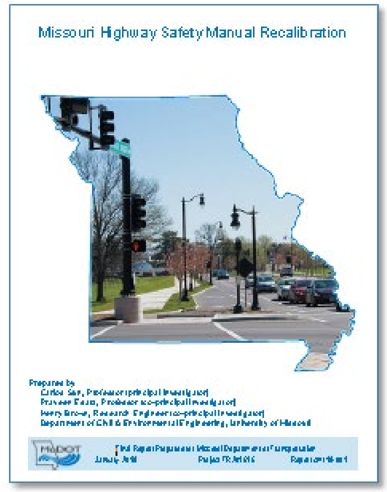
Research Summary

Missouri Highway Safety Manual Recalibration

The new Highway Safety Manual (HSM) is a national manual that facilitates the quantitative evaluation of safety. HSM contains models that need to be calibrated in order to reflect local driver populations, conditions and environments such as driver behavior, geometric design, signage, traffic control devices, signal timing practices, climate, and animal population. A systematic calibration of HSM freeway models to account for such conditions in Missouri was previously performed by the University of Missouri (MU) using 2009 to 2011 data.

MU produced 25 calibration values for 16 different types of transportation facilities including rural undivided and divided highways, urban undivided and divided highways, rural and urban freeway segments, rural stop-controlled intersections, and urban stop-controlled and signalized intersections. These calibration values were published in the MoDOT Engineering Policy Guide for use in all MoDOT districts.

Even though the HSM accounts for exposure variables such as AADT and other safety variables, such as geometrics, signalization, land-use, and lighting, there are other safety-related variables that can change over time. For example, driver behavior could change, with the prevalence of mobile device use while driving being a prime example. Another example is the increase in automotive electronics which, on the one hand, improves safety with features such as



object detection and video monitors, but on the other, could overload driver attention. Therefore, HSM recommends that calibration values be updated at least every two to three years. The Missouri recalibration used three years of data from 2012 to 2014.

The following four step recalibration process was followed: (1) identification of calibration samples/sites, (2) verification/collection of relevant site data, (3) prediction of HSM crash frequencies and (4) fine-tuning calibration parameters by comparing predicted with actual crash frequencies. Steps (1) through (4) were performed for 25 values and 16 facilities. HSM freeway models were subdivided by severity and by single or multi-vehicle crashes, thus three freeway facilities required 12 separate values.

The 16 facilities are:

- Rural 2-Lane Undivided Highway Segments
- Rural Multilane Divided Highway Segments
- Urban 2-Lane Undivided Arterial Segments
- Urban 4-Lane Divided Arterial Segments
- Urban 5-Lane Undivided Arterial Segments
- Rural 4-Lane Freeway Segments
- Urban 4-Lane Freeway Segments
- Urban 6-Lane Freeway Segments
- Urban 3-Leg Signalized Intersections
- Urban 4-Leg Signalized Intersections
- Urban 3-Leg Stop-Controlled Intersections

- Urban 4-Leg Stop-Controlled Intersections
- Rural 2-Lane 3-Leg Stop-Controlled Intersections
- Rural 2-Lane 4-Leg Stop-Controlled Intersections
- Rural Multilane 3-Leg Stop-Controlled Intersections
- Rural Multilane 4-Leg Stop-Controlled Intersections

In step (1), the necessary samples required for HSM calibration were selected. Whenever possible, the random samples from the previous calibration were reused. By reusing previous sites, a sensitivity analysis of the calibration value to an increase in the number of data years could be conducted. However, samples were replaced if they had undergone changes in geometric design or other configuration.

The HSM recommended sample sizes were followed unless Missouri lacked the number of samples or characteristics, or it was inefficient to oversample the number of sites. HSM recommends at least 30 sites per facility and a crash frequency of at least 100 crashes per year over all the sites of the particular facility type.

Step (2) involved the verification of site characteristics to ensure that the site could still be used for recalibration. A changed site requires a replacement and the collection of necessary data associated with the replacement site. The data necessary could include traffic volumes, geometric data, pavement type, and signal control.

Steps (3) and (4) were completed using the FHWA Interactive Highway Safety Design Model (IHSDM) software.

A Table summarizes the recalibration results. Not unexpectedly, the calibration value for some facilities changed from the previous calibration. These changes are due to natural data variability, driver behavior changes, changes in crash reporting, and, in a few facilities, a modification in how data was collected. Reasons specific to each facility are discussed in more detail in the facility-specific chapters. The two highest calibration values, urban three-leg and four-leg intersections, continue to be high following the previous calibration values. The development of Missouri-specific safety performance functions is recommended for these two facilities.

In order to develop crash severity distributions, the crash severity of every crash in a particular type of facility in Missouri was tabulated in a second Table. These sites were not limited to the calibration sites but were developed from every possible site in Missouri. The severity levels of interest are fatal, severe injury, minor injury, and PDO. This Table summarizes the severity distribution factors for Missouri.

The facility types with the highest FI (fatal plus injury) crash proportions include rural two-lane undivided highways, rural two-lane four-leg stop-controlled intersections, and rural multilane three- and four-leg stop controlled intersections. By using this Table, crash frequency by severity can be derived by multiplying the severity distribution factor values by the predicted total crash frequency obtained from the calibrated HSM.

Project Information
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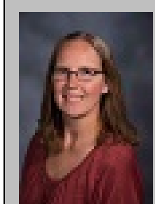

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